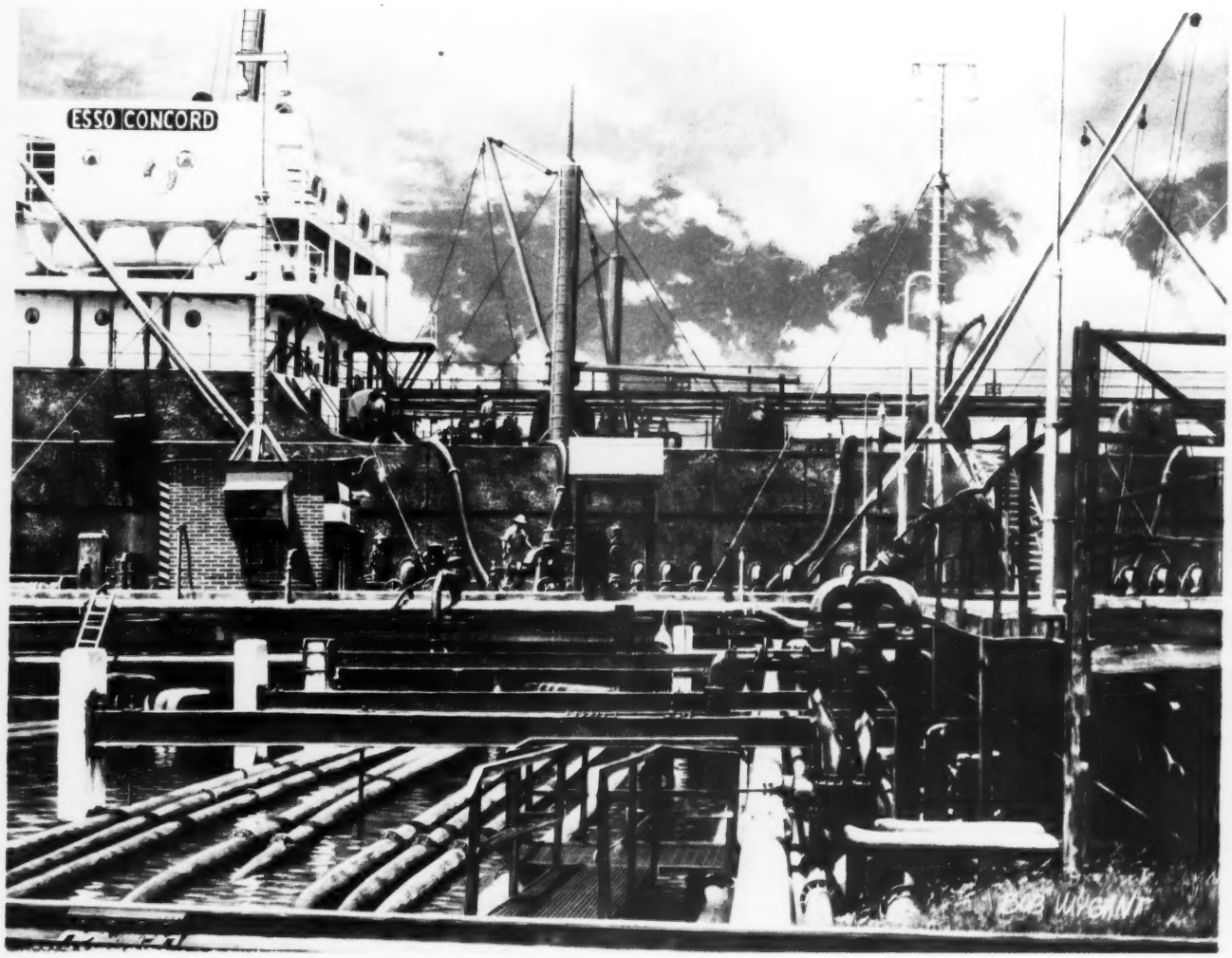
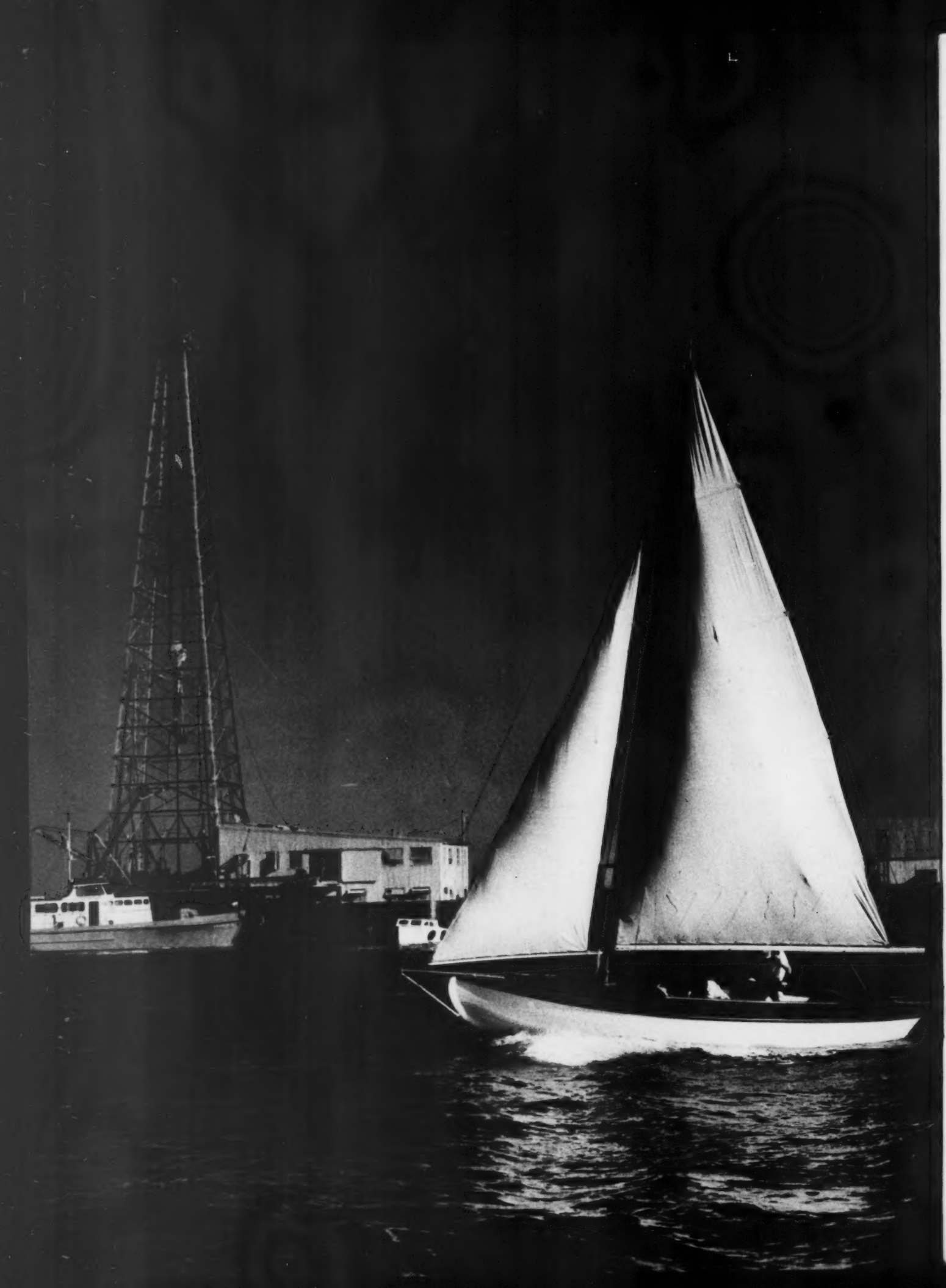


Oil Moves by Tanker — *Bob Wygant*

The HUMBLE WAY

JANUARY-FEBRUARY, 1952



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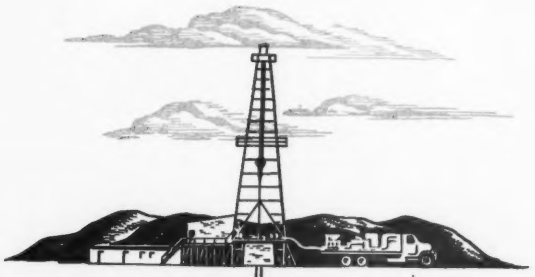


CRACKING THE ROCK CURTAIN

A RECENT visitor to Humble's West Texas office hefted a chunk of brittle, slate-colored rock and slowly shook his head. "Do you mean to say," he asked a petroleum engineer, "that you can actually get oil out of this stuff?"

It was a fair question. To an untutored eye, the core from an oil sand may look hard as granite and as dry as petrified wood.

Strange as it may seem, even grizzled oilmen are a little surprised at the progress the industry is making in coaxing oil from tight-rock formations hitherto deemed too astringent to produce. For finding where oil is stored in the earth is one thing. Getting it to the surface is another and sometimes more difficult problem.

Take for example the far-ranging Spraberry Trend. Here, on the sandy plains southeast of Midland is rapidly being developed an oil field of whopping size—in area the world's largest. For many years, geologists have known there was oil in the so-called Spraberry Sand. But so tight a formation is the Spraberry, so stubborn its resistance to moving fluids, its oil was thought to be locked behind a rock curtain.

Now this curtain has finally been cracked, unleashing a new flow of oil into the national reserves. How it was done is a success story of the most precise and advanced of production techniques. Among the most important of these is a well stimulation method which only 10 years ago was just a theory and which even today has been in common use for less than three years.

Its name: formation fracturing.

Well stimulation methods are, of course, old hat to the industry. For nearly 90 years it has been using nitro and other explosives to blast open drainage areas for oil. Just about as old is the use of acid to etch flow channels to the wellbore. But formation fracturing, today better known by such trade names as Hydrafrac and Strata-frac, bears little likeness to the older techniques.

Core from oil-bearing formation shows type of fractures which help oil flow.

"Formation fracturing," an engineer explains, "is an entirely new way of stimulating a well. It works like an Atlas, with hydraulic pressure taking the place of muscles. It pushes a formation apart and puts in a wedge of sand grains. The oil can then more easily flow out."

More specifically, here is what happens when this method is used to prod a well into flowing more oil: You mix up a viscous, jelly-like material, and to it you add some very fine, round-grained sand. This you pump into the well under high pressure. The tremendous pressure forces the gel into the formation, either creating new fractures or extending fissures which already exist. The gel then reverts to a fluid and flows back to the wellbore, leaving the sand to prop open the fractures.

What you have done is increase the permeability of the formation. Oil, to be economically recoverable, must occur in a formation which has adequate porosity and permeability. By porosity

White sails and dark water contrast in picture of quiet beauty as sailboating visitors glide near drilling rig on Corpus Christi Bay.

Gel recipe calls for careful on-the-site mixing. Crew first adds powdered soap to kerosene in mixing vat, then stirs well with jet guns. "Finger test" tells them when gel is ready for the third ingredient, a round-grained sand used as propping agent.

is meant the sponge-like quality of an oil sand—the amount of storage space existing between the individual grains of sand. Permeability refers to the ease with which oil can flow between these pores. In a tight formation, one with low permeability, fractures even one-fiftieth of an inch wide can greatly increase the flow of oil.

"Even though a formation is tight," remarks one engineer, "the oil might eventually drip out if we stayed with it for a thousand years. But we can't afford to wait that long. You can't economically drill a $100,000 well and get only five barrels of oil a day. It won't pay out."

That's why formation fracturing is so important, not only to the oil industry but also to the nation. Oil is now flowing from wells which only a few years ago would have been marked off as failures or as only marginal producers. This means a substantial addition to America's economically recoverable reserves.

A few case histories point up this fact. One well had yielded no oil for two years. After formation fracturing, it made 50 barrels a day. Another well jumped from 15 barrels a day to 120. A trickling older well, about to be abandoned as worn out, got a new lease on life when it started flowing six barrels a day after being Hydrafraced.

No miracles, however, are claimed for the new technique. Says one service man: "The treatment can be a success, a formation can be thoroughly fractured, but the patient will die if there's no oil."

Even where there's known to be oil, formation fracturing is still a gamble—and one with high stakes. The cost in materials and rig time may run as much as $3000 on a small job to more than $5000 on a big one. It all depends on the treatment size, which is usually reckoned in multiples of 750 gallons of gel. Treatment sizes most often prescribed are 1500, 2250, and 3000 gallons, although a well-gorging 8000 gallons were used on one gargantuan job.

This amber gel is something totally unlike anything ever whipped up in a kitchen. Special service crews mix it at the rig site, using kerosene, an oil-soluble soap and a dash of water as ingredients.

Kerosene is the fluid base to which the gelling agent—a powdered soap—is added. The latter, often as not, is Napalm, the same soap used in the gasoline fire-bombs of World War II. A tiny amount of water is included to cause the gel to break down and revert to a fluid after several hours of exposure to high underground temperatures.

To this mixture is added the propping agent—Ottawa sand, a round-grained sand of uniform consistency which comes from Ottawa, Ill. The usual proportions are about one-half pound of sand to each gallon of gel.

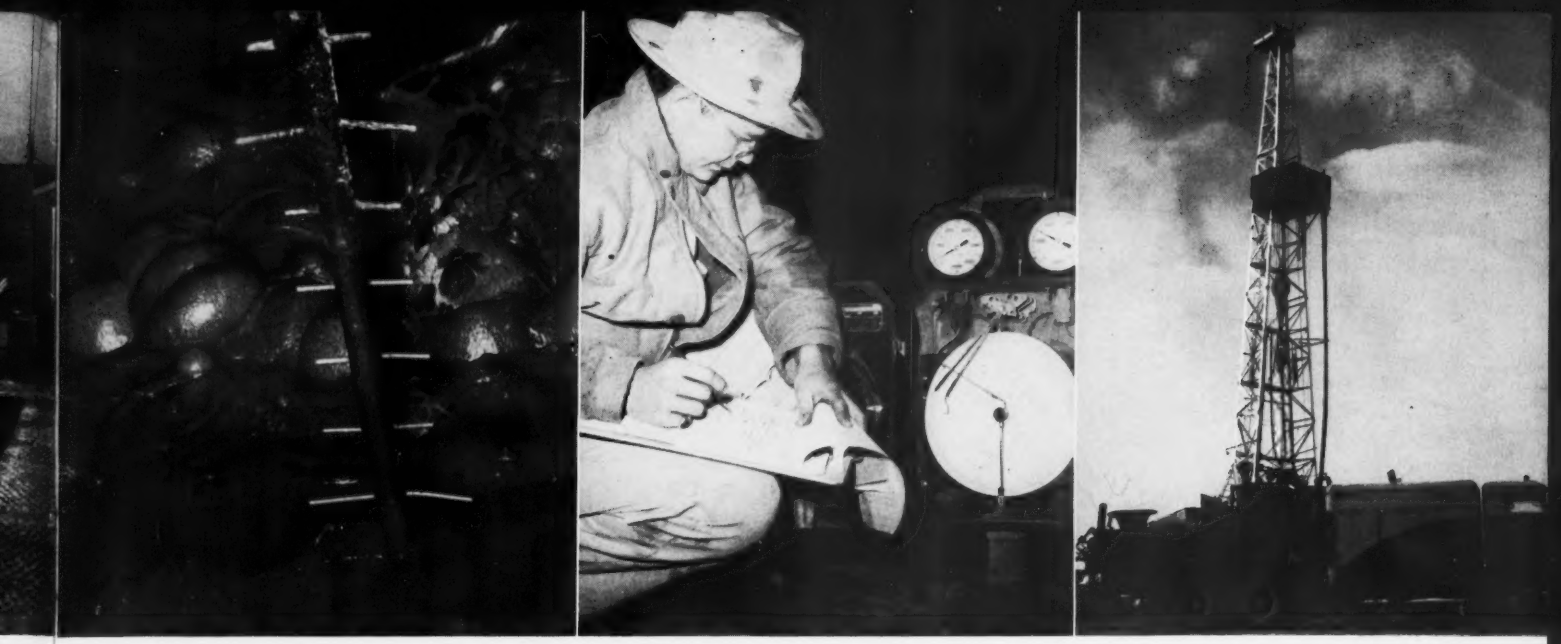
Let's whisk out to West Texas and watch a typical Humble well get a 3000-gallon treatment, this one by Hydrafrac. You'll find most treatments are applied in the open hole, but ours is to squeeze through the casing, 50 feet of which has been perforated four shots to the foot.

The time is shortly before daybreak, and a chill wind is whipping dust and tumbleweeds across the level, mesquite-dotted ranchlands. Into the circle of light cast by the rig's unfrosted bulbs rumbles a caravan of trucks. Two of the jouncing vehicles are of the type used in cementing casing. Each has a pair of powerful diesel pumps humped behind its cab. Another truck groans under the burden of a long metal tank inside which is sloshing 3000 gallons of kerosene. A fourth vehicle is the "steamer"—a small truck with a heating unit.

Already on the site, having been moved there the day before, is a large steel mixing vat. Stacked near it are containers and sacks holding 1000 pounds of Napalm, 1600 pounds of Ottawa sand.

A Humble engineer gives you a fast fill-in. The zone to be Hydrafraced, he says, is a 50-foot section a little above bottom of the 8235-foot hole. This zone has been effectively isolated with a cement plug below, a hook-wall packer above. An acid mud—500 gallons of it—has been pumped in to clean the perforations. Now they've just about finished swabbing this out.

There is only a short wait till the next step: breaking down the formation as much as possible with oil. The tubing



Bubbling gel has consistency of thin cooked cereal when pumps start forcing it into well. Company engineer watches gauges for pressure drop which indicates formation is taking gel. At right, before jack-knife rig, is one of huge pump trucks.

is filled with crude, and four barrels are forced out into the casing and through the perforations. This dosage absorbed, the well is ready for the Hydrafrac gel.

The service crew swings into action and starts mixing gel in the long apple-box-shaped steel vat. First to go in is the kerosene. Then comes the Napalm, a half-ton of amber soap flakes. Since the gel forms better if the kerosene is warm, steam is jetted in to bring the fluid to about 80 degrees.

Jet guns are used to agitate the mixture. Similar to guns used in mixing drilling muds, these suck in the fluid, squirt it back in jet-like streams. Occasionally a crewman dips in his hand and lets the gel run through his fingers. When the gel reaches the consistency of thin Cream of Wheat, the sand is dumped in. By this time it is dawn.

The pumps—three at first and eventually all four—are connected and started. The gel begins surging down the tubing and out into the packed-off casing, forcing the remaining oil ahead of it into the formation. The gel is pumped in fairly fast—about eight barrels a minute. "A fast pumping rate," says the engineer, "helps the gel to outrun any tiny cracks in the formation. It exceeds their ability to take fluid."

Under relentless pressure from the pumps above, the gel has to go somewhere. That somewhere is the formation. The gel thereupon opens and extends incipient fractures or makes entirely new ones.

Our engineer keeps a close watch on the pump pressures. This time they vary between a minimum of 2400 pounds per square inch and a maximum of 3200 pounds. When there is finally a break in the pressure, the engineer knows the formation has cracked and is now taking gel.

Our engineer explains that the gel would revert to fluid of its own accord in about 24 hours, but to save time it is customary to follow it at once with a breaker agent of crude oil and a special chemical. The breaker agent tracks down the gel, thins it back, and the well is again ready for swabbing. This final step brings up all the fluids—breaker agent, kerosene and crude oil—but leaves the grains of sand as props for the fractures. The well is now ready to go on production.

Sometimes startling to many of us is the fact that surface pumps are actually able to lift the overburden of earth, or weight of the overlying strata. Theoretically this takes slightly less than one pound per square inch per foot of depth. At 5000 feet, say, you would need about 5000 pounds of bottom-hole pressure to fracture the formation by lifting the overburden. More than a third of this would come from the hydrostatic head, or weight of the fluid column in the well. The rest would have to be provided by pumps.

In actual practice, it is not always necessary to lift the overburden. In the Spraberry, for instance, there are lines of incipient weakness and a series of jam-tight vertical fractures. These will break down, opening up flow channels for oil, at a pressure considerably below that theoretically needed to lift the overburden.

Not all the sand, it's been found, will stay in the fractures. Some is later produced with the oil, and some has been found at the bottom of the hole. Even so, this sand is believed to have performed a valuable function by scouring the fissures.

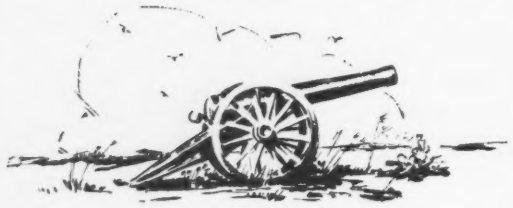
Humble was one of the early users of formation fracturing. The first Hydrafrac treatment in the Spraberry Trend took place in a Humble well in September, 1950. In the year following, more than a thousand treatments by Hydrafrac alone were applied in the Spraberry. In recent months, the combined figures for all types of formation fracturing has been climbing at an even faster rate.

A new wrinkle has been added to the fracturing technique by Strata-frac, another leading process which has successfully stimulated many Humble wells. The Strata-frac process uses an acid-kerosene gel, the acid acting as a solvent for silicates and calcareous matter which might otherwise clog the fractures. In effect, fracturing is here used in combination with acidizing.

The oil industry is not, of course, resting on its laurels. It never has.

Other rock curtains remain to be cracked, and a constant search is going on for new techniques—for more efficient, more economical ways of providing the nation with fuel.

THE BORDER FORTS



Cavalry forts which once kept order along the Rio Grande have been converted to serve productive purposes of peace and education

FOR MORE than a century, no cannons have roared in anger across the yellow waters of the Rio Grande. But it was many years after the guns grew quiet at Palo Alto and Resaca de la Palma that military trouble finally disappeared from the disputed border.

Long after the Treaty of Guadalupe-Hidalgo, outlaws like Juan Cortina and Pancho Villa made border life unpleasant and uncertain. Between bandit thrusts came Indian forays—stealthy raids across the Rio Grande for livestock and other loot. During our own fratricidal War Between the States, flame and sword swept across the *resacas* and *mesquite*-studded plains along the Rio Grande. Destiny itself seemed determined to make the border a battleground.

For security, the United States established a series of cavalry forts along the river. Cavalry was the mobile warfare of those days; the only means of moving troops over a large area in a short time.

Of the forts on the Rio Grande, only Fort Bliss at El Paso is still active. Fort Brown at Brownsville, Fort Ringgold at Rio Grande City, and Fort McIntosh at Laredo—all cavalry training centers for many years—were shut down after the end of World War II. Significantly, every one of these three is now used as a school. A fourth, Fort Clark at Brackettville, has been bought by private interests and converted into a beautiful guest ranch—the kind of place that makes any old trooper stare in amazement and reflect that "the army was never like this."

Texas Southmost College now uses most of the buildings at Fort Brown. Buildings at Fort Ringgold serve the Rio Grande City school system, and there is talk of establishing a junior college there. Barracks and many other principal buildings at Fort McIntosh have been taken over by Laredo Junior College.

Thus have the tools of war been reshaped to the purposes of peace and education. Gone from the scene is the clanking saber, the thundering hoof, and the crunch of cavalry boots on stone. No more does the high-pitched trill of "Boots and Saddles" pierce the air as the regiment makes ready to take the field. Over all now hangs an almost monastic quiet. Laughing students move about under the cloistered archways. Trees and grounds blend in such a dream of peace that it is difficult to remember a time when battalions in battle array passed in review.

Artist E. M. Schiwetz presents on these pages the historic forts as they appear today—in a happier, more productive, time when school bells have replaced the bugle's battle notes, when parade grounds resound to nothing more militant than the tread of students between classes.

Fort Brown: A stone set in 1936 at the entrance to Fort Brown, near the Gateway Bridge between Brownsville and Matamoros, proclaims it the oldest permanent fort in Texas. When Gen. Zachary Taylor's troops threw up earthworks there in March, 1846, he referred to it in dispatches as "The Camp on the Left Bank of the Rio Grande," and "The Camp Opposite Matamoros."

A briefer name was in order, and Fort Taylor it soon became. But when Major Jacob Brown of the 7th Infantry died there on May 9, 1846, of cannon wounds received a

few days before, the fort was renamed in his honor.

Original fortifications were earthworks in the form of an irregular six-pointed star. Protecting an 800-yard perimeter were six bastion walls 9½ feet high, with parapets 15 feet wide, surrounded by a ditch 8½ feet deep and 15-20 feet wide. Only a remnant of the old walls remain today, marked by an inscribed stone and a cannon barrel, thrust muzzle-up toward the sky.

A permanent post was made of Fort Brown in 1849, but most of its present buildings date from a somewhat later time. Histories of the old post hospital and morgue are particularly exciting. It was here than Gen. William Crawford Gorgas (then a young 1st Lieutenant and assistant surgeon) began his personal battle against an enemy deadlier than man—the dreaded Yellow Jack.

Yellow fever struck heavily at Fort Brown in 1882. The death rate was high, and graves were hastily dug in advance for all who fell ill. Once the fever struck, few survived, and bodies were buried as quickly as possible. According to tradition, Gorgas was under strict orders not to carry on any examinations or experiments that would bring him in contact with the dead. He disregarded the orders, working all the harder at his search for the cause of yellow fever. Even when officers surprised him one night working in the morgue, he refused to give up the search. Eventually, Gorgas fell victim of the disease he was trying so valiantly to disarm.

But in his case, the malady was more Cupid than killer. Burning with the same fever in a house adjoining Gorgas' was a lovely young lady, a Miss Marie Cook Doughty, who had more than once caught his eye before both fell ill. The same servant fed both while the fever raged on, taking tea and toast to Gorgas after Miss Doughty had been served. Messages passed back and forth between the two stricken young people. Gorgas, undecided whether to pronounce the lady's name *Doty* or *Dowty,* settled for the more whimsical "Miss Tea and Toast."

Their story ended as all romantic stories should. Both recovered, by some miracle, and they were later married. Meanwhile Gorgas launched himself back into the battle against yellow fever as soon as strength would permit. It was a fight he continued late into his life, carrying his studies with him to stations in Cuba, Panama, and South America. His success at last won him respect and honor in his profession and the love of a grateful world. A wooden plaque on the post hospital at Fort Brown (replaced in 1948 by a bronze tablet) made it clear that it was largely through Gen. Gorgas' efforts that yellow fever no longer menaces the Western Hemisphere.

Pictorially, Fort Brown is perhaps not too different from its appearance 75 years ago. The hospital, its bricks painted a neat white, serves as classrooms and offices for Texas Southmost College. Barracks and nearby buildings are used for additional classrooms and other college work. For a time, the old morgue was done over to serve a livelier use as headquarters for the Brownsville Art League. Later, the League moved its quarters farther over on the fort grounds and occupied the renovated Neale House, itself a historic Brownsville structure more than 100 years old.

The horseshoe-shaped *resaca* (water-filled channel cut by the overflowing Rio Grande) is still there, but the national cemetery that once occupied the land in its center has been moved to Pineville, Louisiana, across the Red River from Alexandria, to escape the river's perennial rages. On this land, which was once an island, the old caretaker's house still stands—a gaunt and bare skeleton, its screens hanging loose and flapping in the wind.

Tall royal palms look down today upon a parade ground turned into a college campus—upon a scene little different from any college campus anywhere. But no one can reflect even briefly upon the history of Fort Brown without remembering the men who passed that way and made it great: "Old Rough and Ready" Taylor, the distinguished Indian fighter who later became President of the United States; the gallant Major Brown, who died in battle there; Robert E. Lee, the gentlemanly "Marse Robert," who visited there in the 1850's; Col. John S. (Rip) Ford, Confederate commander of Fort Brown during the War Between the States; his successor, the great cavalry leader, Gen. Phil Sheridan

who took over in 1865; Gen. Gorgas, stout-hearted surgeon with a soldier's courage and a researcher's determination; Gen. Jonathan Wainwright, who reviewed troops there in 1940 and soon after became the hero of Corregidor.

These and many others left part of their name and fame behind them at Fort Brown.Theirs is a story of devotion to duty that follows the best traditions of the service. Beyond doubt, if they had their choice, none would suggest a better use than is now being made of the place they served so well.

Fort Ringgold: Fort Ringgold, another cavalry post overlooking the Rio Grande, was established October 26, 1848, by Capt. J. H. La Motte, 1st U. S. Infantry. La Motte chose a location on the river near Davis Landing, named for Henry Clay Davis, a Kentuckian who came to Texas in the 1830's and became a pioneer rancher. Later, Rio Grande City grew up around Old Rancho Davis.

The fort was named for Brevet Major David Ringgold, who joined Gen. Zachary Taylor at Corpus Christi in 1845, took part in the early phase of the Mexican War, and died a hero of wounds received at the Battle of Palo Alto, May 8, 1846.

Troops were withdrawn from the fort on March 3, 1859, but Ringgold was not to remain long vacant. Spurred on, perhaps, by the Cortina trouble, troops reoccupied the fort on December 29 of that same year.

Robert E. Lee visited Ringgold a few days in 1856 and again in 1860, when he had been sent down to investigate the Cortina trouble. Juan Nepomuceno Cortina had first run afoul of the law in Brownsville during the middle of 1859. Matters grew progressively worse, and in September this self-styled Robin Hood of the Border and champion of the people rode with a force into Brownsville, shooting up the town and terrorizing its people. Chased later across the Rio Grande, he faded into the brush and emerged at intervals to harass border ranches and play tag with soldiers and Texas Rangers.

Lee, who soon was destined to lead the forces of the Confederacy when he could not bring himself to take up arms against his native Virginia, disposed of the Cortina matter with soldierly dispatch. Working with the War Department, with Texas authorities, and with the Mexican Government, he secured co-operative action that ended the trouble. Cortina withdrew into Mexico, joined his country's army, rose to the rank of brigadier general, and later became governor of the State of Tamaulipas.

During his stay at Fort Ringgold, Col. Lee occupied a small frame building atop a gently rising knoll. Still known as the Lee House, it stands today in surprisingly good condition. Nearby, looking like tank traps, stand the ruins of the old water tower foundations.

Ringgold Barracks, as it was then known, was occupied only part-time during the Civil War. Late in 1862, about 1200 men were stationed there under the command of Col. P. N. Luckett and Col. John S. (Rip) Ford. Gen. Hamilton P. Bee took over the Confederate command there in February, 1863. Gen. Bee took his forces out of the fort on November 2, 1863.

In June, 1864, Col. Ford directed his troops in systematic guerrilla warfare against Federal outposts in the Rio Grande Valley area. On June 16, he occupied Rio Grande City and the Federals withdrew toward Brownsville. Ford pursued them and, with five regiments and one battery, took quiet possession of Brownsville in July. At the close of the Civil War, Federal troops re-entered Ringgold and remained until they were replaced by National Guard troops at the outbreak of the Spanish-American War in 1898.

The fort was slated for abandonment in 1906. Property

was snipped out, the reservation with all buildings was transferred to the Department of the Interior, and in 1912 a proposal was made to sell the land as townsite lots.

But in 1913 troops from the 13th Cavalry were ordered here in response to internal troubles in Mexico. Border troubles continued. In 1917 the fort property was transferred back to the War Department and extensive improvements were begun. From that time until the close of World War II, successive cavalry units occupied Fort Ringgold almost continuously.

Today, most of the grounds and buildings have been taken over by the Rio Grande City school system. The old stables serve as livestock and poultry facilities for agriculture students. The old post headquarters is now the school band room. Barracks and other buildings have been converted into classrooms. Dotting the grounds and contrasting with the royal palm trees are clumps of salt cedars, serene with soft green foliage. It is a far cry from the dangerous days of war.

Fort McIntosh: From 1846 to 1848, Laredo was held for the United States by a company of Texas Mounted Volunteers under command of Capt. Mirabeau Buonaparte Lamar, the second President of the Republic of Texas. Before he was mustered out of the service at the close of the Mexican War, Capt. Lamar, fearing future Indian attacks, advised Gen. Zachary Taylor not to leave Laredo unprotected. His letter read, in part:

> "Before leaving here, however, I will respectfully suggest to the General the propriety of not breaking up this post at the present moment. Indians are known to be in this section of the country, seeking to do mischief, and it would seem to me to be imprudent to leave Laredo exposed to their depredations. It is very difficult to restrain the Indians entirely; but the presence of a Military force here is considerable protection without which the place will probably be doomed to calamity. . . ."

That must have sounded like good advice to Gen. Taylor. On March 3, 1849, an Army post was established at Laredo near *El Paso de los Indios* (Indian Crossing) on the Rio Grande. The post was named Camp Crawford for George W. Crawford, Secretary of War.

On January 7, 1850, the name was changed to Fort McIntosh in honor of Lt. Col. James S. McIntosh, who died in 1847 from wounds received in the Battle of Molina del Rey.

Originally, Old Fort McIntosh was a star-shaped earthwork covering about one acre and built on a bluff about 50 feet above the Rio Grande. Frequent brushes with Indians later bore out the wisdom of Lamar's advice to keep the area protected. History records that Lt. Walter W. Hudson was mortally wounded in a battle with Indians and died at Fort McIntosh April 19, 1850. Camp Hudson, in Val Verde County (1857-1868), was named for him.

An interesting story about early Fort McIntosh comes from Gen. Phil Sheridan, who spent a few days there in 1854. Sheridan entered this note in his personal memoirs:

> "We arrived at Laredo during one of those severe storms incident to that section which are termed 'Northers' from the fact that the north winds culminate occasionally in cold windstorms, frequently preceded by heavy rains . . .
>
> . . . Just before the 'Norther' began, the troops had completed a redoubt for the defense of the post, with the exception of the ditches, but as the parapet was built of sand—the only material about Laredo which could be obtained for its construction—the wind was too much for such a shifting substance, and the work was entirely blown away in the storm. . . .
>
> . . . Lumber on the Rio Grande was so scarce in those days that to possess even the smallest quantity was to indulge in great luxury. Indeed, about all that reached the post was what came in the shape of bacon boxes, and the boards from these were reserved for coffins. . . ."

In 1858, Fort McIntosh was abandoned and its stores moved to Fort Brown. But in 1859 the place was regarrisoned with two companies of the 1st Infantry. At the outbreak of the Civil War in 1861, Federal troops left the fort in the hands of the Confederates. In charge was Col. Santos

Benavides, a volunteer commander under Col. Ford. Federal forces reoccupied Fort McIntosh on October 23, 1865, and a new fort was built about ½ mile below the old site.

An interesting, but undocumented, story about the place during the days of bandit uprisings concerns a bugler who blew too soon:

Having reason to believe that trouble was near, the post commander ordered the bugler to sound the call to arms at the slightest sign of anything unusual. During the night, a barracks caught on fire. In his excitement, the bugler sent the strident notes of the call to arms ringing across the barracks area. Leaping from their beds, soldiers hastily pulled on their clothes, seized arms, and rushed down to their positions along the Rio Grande. As they peered anxiously into the night for a glimpse of bandits, behind them, in a deserted fort, the barracks burned completely to the ground.

Like its sister forts along the Rio Grande, Fort McIntosh has a roster full of distinguished military men and statesmen. Besides Capt. Mirabeau B. Lamar, who advised its establishment, there was Capt. Hamilton P. Bee, later the first County Clerk of Webb County, who became a general in the Confederate Army. There were the Benavides brothers; Col. Santos and Captains Refugio and Cristobal, who served so well in suppressing brigands and Indians along the border during and following the Civil War.

There was Capt. John Z. Leyendecker, who did such a good job as Quartermaster for the Confederacy that he was retained by the Federal forces when they reoccupied the fort. There were Maj. C. C. Sibley of the 3rd Infantry; Major D. B. Clendenin, the nemesis of border outlaws; distinguished surgeons like Dr. Henry Spohn and William C. Gorgas; and others who rose high in the service of their country: General Funston, General Miles, General S. M. B. Young, General J. C. Harbord, General Beaumont B. Buck, and a host of others.

All would have some difficulty recognizing Fort McIntosh as it is today. It was shut down as a cavalry post at the close of World War II, and part of it has since been taken over by Laredo Junior College. One of the old barracks has become the college's Administration Building; another a Liberal Arts Building; and another the Science Building. The post chapel and library has remained to serve the same functions for the college. Next to it, the post jail has been made over into headquarters for the college maintenance men. The old arsenal, once dirty with oil and grease left after cleaning rifles, has been transformed into a neat and beautiful Homemaking Building. In the center of a ring of buildings, and making the place look all the more like a college campus, is the old parade ground.

Visitors today cannot escape the impression that the place looks much more like a college than it does a fort.

Fort Clark: Long before Fort Clark was established in 1852 on Las Moras (mulberries) Creek, bubbling springs that fed the stream were making history. History records that the springs were used by Lipan Apaches, superstitious savages who ascribed miracle powers to the waters of Las Moras. "Who washes here is cleansed of guile. The mantle of truth descends upon him," said the warlike Apaches.

In 1834, the first colonists were brought to the land around Las Moras by Dr. John Charles Beales, who had a Mexican grant of three million acres acquired through his wife, Dolores. Their dreams of colonization were shattered in 1836, when Santa Anna and his army approached the Rio Grande on their way to the Alamo. The colonists, fearing the worst, fled from the frying pan into the fire. They escaped Santa Anna, only to be ambushed and massacred by Comanches. Two women and five children survived.

Then came the forty-niners, avoiding snows by taking the southern route to California. They, too, were beset by Indians, and the government decided to do something to make the place safer. On June 20, 1852, Major Joseph Hatch La Motte, who had established Fort Ringgold four years earlier, led two companies of First Infantry, accompanied by advance and rear guards of U. S. Mounted Rifles, to Las Moras Creek and founded Fort Clark. It was first known as Fort Riley, but was renamed Fort Clark on July 15, 1852, in honor of Maj. John B. Clark, killed in the Mexican War.

Quarters were temporary at first; the first stone stockade was built as a corral to protect horses in 1855. Still the Indians raided. During its first decade, scarcely a day passed that Fort Clark did not send out men to fight.

During the 1850's, Robert E. Lee visited Fort Clark briefly. He was never stationed there, but apparently he stayed long enough for an old log cabin on the fort grounds to be pointed out today as "the place where Lee held court." History records that Lee attended courts-martial at Fort Brown and Fort Ringgold. Apparently he visited Clark while leading raids out of Camp Cooper, his "home in Texas."

Civil War put Confederates in command of Fort Clark. It was not until December 12, 1866, that Federal troops reoccupied the post.

By 1867, huge wagon trains, some with as many as 300 mules, began gathering in San Antonio and freighting to California. This was the day of the "prairie schooner," a huge, heavy, highwheeled wagon.

Fort Clark was the watering place for the wagon trains. Brackettville, founded about the same time as the fort, became a frontier town. Old timers of the West, teamsters, investors, merchants, buffalo hunters, and gamblers thronged the streets. Mingling with them were cattle rustlers, professional claim jumpers, and desperadoes, all carrying single-action revolvers at the thigh.

It was the job of Fort Clark troops to protect the wagon trains from the Indians. In those days, Comanches and Kickapoos were striking from great distances and withdrawing rapidly. Trail readers were badly needed. It was then that Lt. (later general) John Bullis enlisted Seminole scouts to interpret broken twigs, deer tracks, and other signs that Indians had been near.

The story of how Seminoles were enlisted as scouts by Fort Clark is an interesting one in itself. The Indians themselves had been transferred after the Seminole War from Florida to a reservation in Oklahoma. With them were transferred Seminole Negroes, originally runaway slaves who had joined the Indians in Florida. Their relationship with the Seminoles has been described as a "vassals and allies" relationship, rather than master-and-slave. The Negroes lived in separate villages, had their own fields and herds, and went into battle under their own leader. Except for a yearly

OFFICERS ROW
FT. CLARK, TEX.

THE POST EXCHANGE AND WAREHOUSE
FT. CLARK

tribute of corn to the chiefs who were their protectors, they lived as free a life as the Indians themselves.

Neither the Seminole Indians nor the Seminole Negroes, who had become intermixed with them, were happy on the Oklahoma reservation. Many of the latter were kidnapped into slavery. In 1850, a large number of them moved to Mexico—the Indians under command of Chief Coacoochee (Wild Cat); the Seminole Negroes under their leader, John Horse, better known by his nickname of Gopher John.

From Mexico, a number of Seminoles and Seminole Negroes enlisted as scouts at Fort Duncan, across the river at Eagle Pass. Later some moved farther inland and became scouts for Fort Clark. The scouts did a good job; by the time the railroads came to begin a new era—though the rails missed Brackettville by a few miles—marauding Indians has practically disappeared.

The list of those who were stationed at Fort Clark, or who visited there, is almost an honor roll among the military great. We have the authority of onetime Chaplain Cephas Bateman for this: "To have 'served at Clark' was at one time nearly equivalent to honorable mention, for such an entry in one's record was a sure token that the . . . individual had been really initiated into army life."

Chaplain Bateman also declares, "It was during a tour of inspection of army posts, which included Fort Clark, that Gen. (Phil) Sheridan is said to have expressed a possible preference for the Inferno rather than Texas as a place of residence."

OLD STORE HOUSE — FT CLARK

The good chaplain was watching his words rather carefully. What Sheridan really said is reported to have gone more like this: "If I owned both Texas and Hell, I'd rent out Texas and live in Hell."

Other great names stand out brightly in the history of Fort Clark. Gen. George S. Patton served as commander there. Jonathan Wainwright served there as a young lieutenant, returned in later years as the post commander, and was ordered from there to duty in the Pacific during World War II. (He returned for a visit in December, 1951, staying at the same house where he had lived during his tour of duty as commander of Fort Clark.)

But as recognition is made of the old fort's officers, one must not forget the brave troopers who fought and died there. Once there stood in the old post cemetery a headstone in memory of a young cavalryman who died of wounds received in an Indian skirmish in 1873. Its inscription might serve as a memorial for all who went that way:

"O pray for the soldier, you kind-hearted stranger,

He has roamed the prairie for many a year.

He has kept the Comanches away from your ranches

And followed them over the Texas frontier."

Fort Clark no longer serves as an army cavalry post. After World War II, it was bought by private interests and converted into a jewel of a guest ranch. Today, cowboys in embroidered shirts and fancy-booted ladies roam its well-cared-for acres and enjoy its luxurious comfort. Still, there is a certain feeling of historic remoteness all around the huge old fort. The cavalry-and-Indians atmosphere is still there, and not even time will dispel it. Though resplendent in a new dress of green paint and white stone, the fort buildings seem always prepared to repel a Comanche attack, as if hordes of painted redskins might at any moment come whooping down out of the hills. Fort Clark Ranch, as it is now called, employs a number of descendants of the original Seminole scouts, and these give the place an authentic touch, highly reminiscent of a time long gone.

Today, guests at Fort Clark Ranch find it a pleasant place where people of our own time live and enjoy the historic surroundings of heroes of our past. Fort Clark has at last fulfilled its mission: to make the land around Las Moras a place where peaceful people can live in peace.

Summer Planning Against Winter Cold

Keeping nation warm in winter and mobile in summer takes large investment, hard work, shrewd planning

BITTER winds wail down from the North. Landscapes in some parts of the country look like something out of Whittier's "Snowbound," and still the mercury drops. One look outside is enough to convince most people that Miami is a good place to spend the winter.

How reassuring it is, after consulting a low fuel gauge, to order a load of heating oil for the family furnace and hear that cheery "We'll send it right over, sir!"

Now consider, for a moment, the work and planning and coordination that make it possible to put that load of oil down where and when it is needed. It's a job that dates all the way back to last summer.

That's right . . . *last summer!* While millions of automobiles sped Americans back and forth across country on vacations from April to November, heating oil (kerosene and distillate fuel) at the rate of 1.6 million barrels a day was being refined for consumption and storage. Tankers, barges, and railroad tank cars—as many as could be pressed into that service—were moving it from refineries and unloading it as close as possible to points of winter sale.

At the same time a lot of gasoline was being manufactured, too. But a barrel of crude oil is a fairly inflexible thing. Last summer, while refineries were getting as much gasoline as they could economically squeeze from a barrel of crude oil, they were also making a high percentage of heating oil. With demand off during the summer, a substantial part of the heating oil must be stored for winter use. A good thing, too—for it would be difficult to coax from the nation's refineries *during winter* as much heating oil as everyone needs in that season. With the first frosts of winter, the country starts drawing on heating oil stored up during the summer.

This seasonal shift in demand for heating oil in winter brings up eternal problems—as inescapable as death and taxes—for most petroleum refiners. About the only leeway they have in actual operations is the 10 to 12 per cent of a barrel of crude oil that can go into either gasoline or heating oil. This small amount of "flexible" material is made up of the heavy naphtha and light gas oil products of distillation. Within specifications, the naphtha can be used in small amounts in either seasonal product. The gas oil can be "cracked" in the summer to make gasoline and in the winter can be chemically treated to make heating oil.

With so little flexibility in normal operations, storage in advance is the best solution to the problem of providing enough gasoline in summer; enough heating oil in winter. In fact, adjusting to the seasonal shift in demand would be impossible without storage tanks. They are as necessary to a refinery as elastic is to suspenders, for both perform the same "adjusting" function.

Seeing that there is *enough* storage, that it is *properly located* to be unloaded quickly when the oil is needed, and that tanks are filled with the *proper oil* at the *proper time* are vexing problems—made all the more difficult by many different grades of products. At the peaks of both seasons, refinery coordinators and oil movements men agree with Thomas Paine that "These are the times that try men's souls."

In planning ahead for best use of storage, it helps to have a fund of plain, hard experience. It helps to have good estimates of consumer demand, to know about the availability of crude oil, and to project what units in the refinery will be down for repairs at certain times. But sometimes the coordinators would trade everything for just one reliable crystal ball!

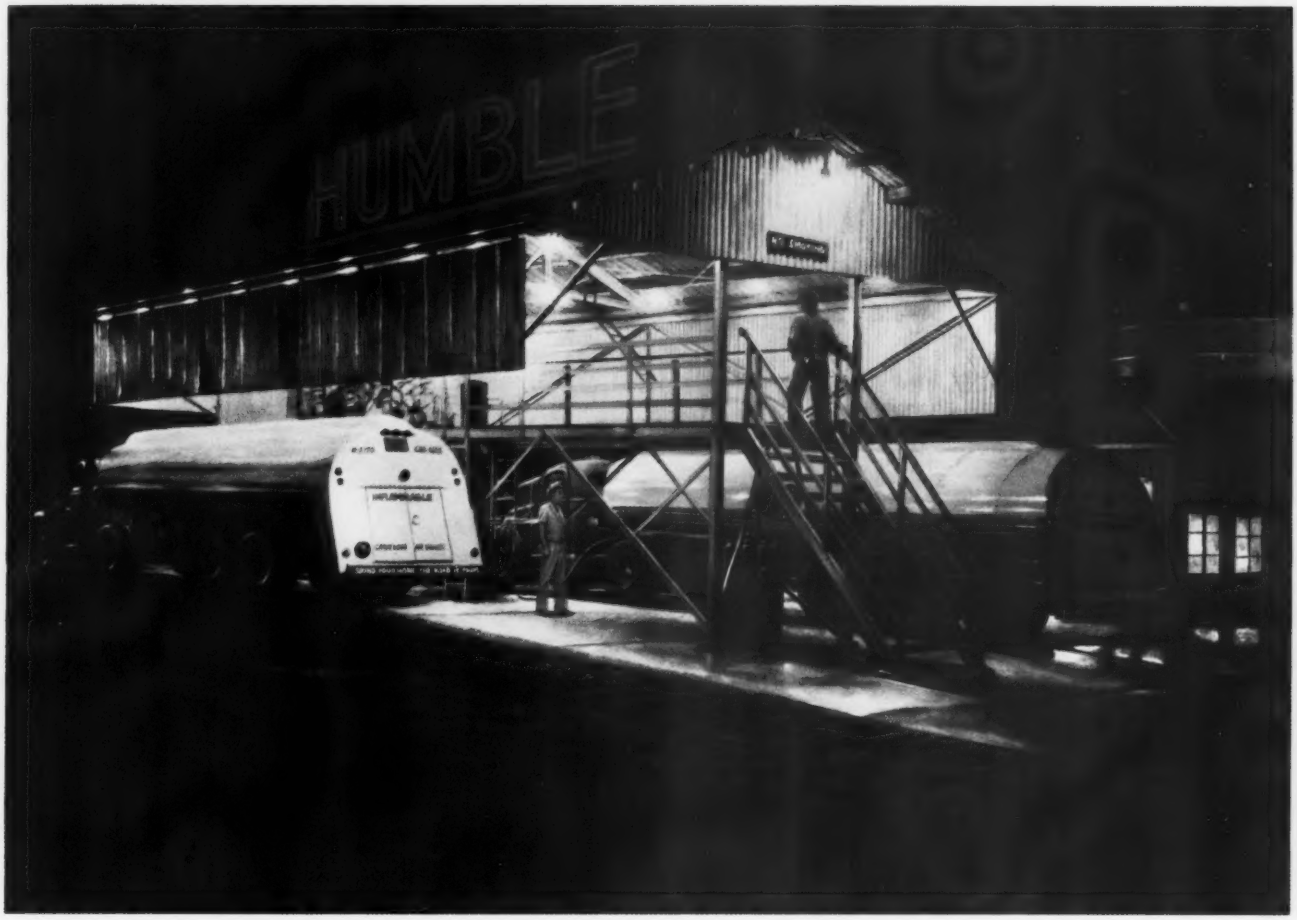
Situations can develop very rapidly to throw the best-laid plans out of kilter. The weather, without warning, gets "much too cold for this time of year"—or much too hot. Hurricanes a thousand miles away disrupt tanker schedules and leave refineries holding the bag—or, in this case, the oil. A major unit that was scheduled to run for another two months suddenly develops trouble and must be shut down for long and costly repairs, altering storage requirements.

When these things happen, someone has to do some quick revising and come up with the right answer, or oil will be pushing the roofs off the tanks. getting tanks switched from one product to another to take care of normal seasonal shifts in demand is difficult enough. But doing it to fit an emergency calls for quick planning and timing.

That anything resembling order comes out of such a situation as this is a tribute to the refinery people who plan the work and to those who work the plans. For everyone who depends on oil for heating, it adds up to this:

Beginning at the consuming season last year (around November 1), heating oil in the United States was being produced at the rate of about 1.8 million barrels a day. Storage on that date, swollen with summer production, amounted to about 137 million barrels. By January 12, 1952, storage had been reduced to about 98 million barrels. Even at a high rate of winter production, nearly 40 million barrels of heating oil had been removed from storage in a little more than two months! It's a good thing that heating oil was produced and stored at the rate of 1.6 million barrels a day all summer. That's the only way the oil industry could do its job of keeping a large part of the nation warm during winter.

Refineries follow a reverse pattern of keeping the nation mobile in summer—by withdrawing from gasoline stocks refined and stored while the heating oil was used last winter. It's work that calls for huge investments, plenty of hard work, and shrewd planning. But try to find a heating oil customer in winter, or a motorist in summer, who says it's not worth it!



Early morning at a gasoline terminal held a certain drama for Artist Bob Wygant's eye. Here, under a huge neon "Humble" that still blazed red in the darkness, trucks were being filled with gasoline for morning deliveries to neighborhood service stations.

An Artist Paints Oil Movements

Bob Wygant is a young Houston artist who looks every pound the football player he used to be. Last July, he drew from THE HUMBLE WAY his first assignment after leaving art school at The University of Texas.

Gathering up brushes and paints, Bob set out for a visit to Baytown Refinery. After a thorough briefing, his instructions from the editor were as flexible as they were simple: "We need a series of pictures on oil movements. Paint whatever looks good to you."

At first glance, Bob knew the Baytown job was to his liking. He was intrigued with huge tankers that nosed, high in the water, up to the Baytown docks and settled slowly as their tanks were gorged with oil.

Men and equipment around the barge docks fascinated him, too, and quickly became subjects for his agile brushes—men wrestling with snakelike lengths of sinuous hose, shirts sticking to their backs as they perspired under a blazing July sun.

On the cover and on these pages are Wygant's impressions of the work of oil movements, including a products terminal at night (above), where outbound trucks are being loaded.

Bob's biggest surprise came when he discovered what was being pumped into the big East Coast-bound tanker he was transferring to canvas. As mercury pushed toward the 100-mark and the nation sweltered under a heat wave, the ship grew heavy with a load of *heating oil*. For an explanation, read the article on the preceding page.

Artist Bob Wygant, busy at his drawing table, puts on some finishing strokes.

Barge Loading at Baytown

Bob Wygant

There's hard work and careful planning behind a station's opening day

SCARCELY a Saturday has gone by in the past six years that people in some part of Texas have not seen this typical scene: a busy street corner or crossroads spot with pennants flapping in the breeze and balloons floating overhead, signifying the formal opening of another Humble service station.

Several hundred important new outlets have been opened since 1946. Each opening has been preceded by careful planning and a program of publicity and promotion. There's a double purpose behind all this effort: to get the station off at a high gallonage level which might otherwise take months to reach; and to give the operator a chance to meet and invite back a large number of potential customers.

Not all of these stations, however, have had the full benefit of today's "complete opening package." That package did not come into being at full stature; it evolved. Into its evolution has been packed a wealth of experience, imagination, enthusiasm, and coordinated effort.

Today's opening package is a flexible blueprint, whether the new station to be opened is in city, town, or hamlet. For each opening some special or localized feature may be used, but in each case such a feature is woven into the broad opening day formula which has proven successful.

Here's how it works.

Some time before official opening date a pattern of activity unfolds under the direction of division sales promotion people. Newspaper and radio advertising is contracted for; orders are placed for favors to be given to visitors. From the Sales Promotion section in Houston and from the Division office, packages of basic decorating and promotion materials go out. Personal calls and letters inform potential customers in the station's trade area of the coming opening.

A day or two before the opening the Division Sales Promotion group ties the whole plan closely together. Trained salesmen of the station's staff, Division and District office personnel, bulk agents and their employees, and volunteers from other stations are scheduled for specific hours at definite jobs; station decorating and stock checking work is assigned for the day before; close contact is kept with maintenance engineers to assure perfect working order of all equipment.

On the afternoon and evening before the opening, key members of the work staff go through their assignments to guard against confusion on opening day. Often the final check to insure complete readiness is made in the late night hours.

On Saturday morning a small regiment of Humble people stands poised for the usual 6 a.m. opening. (Sometimes as many as 100 people are engaged in the many activities that make for a successful opening. Not all of them are Sales Department employees, for the excitement of a big opening day has captured the fancy of employees in other departments of the Company.

From the early opening hour until 10 p.m., or perhaps midnight, the station driveways are as alive as a three-ring circus. Hundreds of cars and trucks flow through. Customers receive a warm greeting and fast courteous service. Favors are given to all mem-

Finishing touches and last-minute checks go on far into night as a new Humble station gets ready for next morning's debut.

Keeping motor oil racks and battery kits filled is one of many behind-the-scenes tasks that help eliminate delays on driveways during rush of opening day business.

Flowers for the ladies and suitable favors for men and children are presented to opening day customers. Below, cars were still being serviced far into the night.

bers of the family: Aloha orchids to ladies, balloons to children, and key rings to men.

When closing time arrives it is usually a tired but happy group that "battens down" the station for the night.

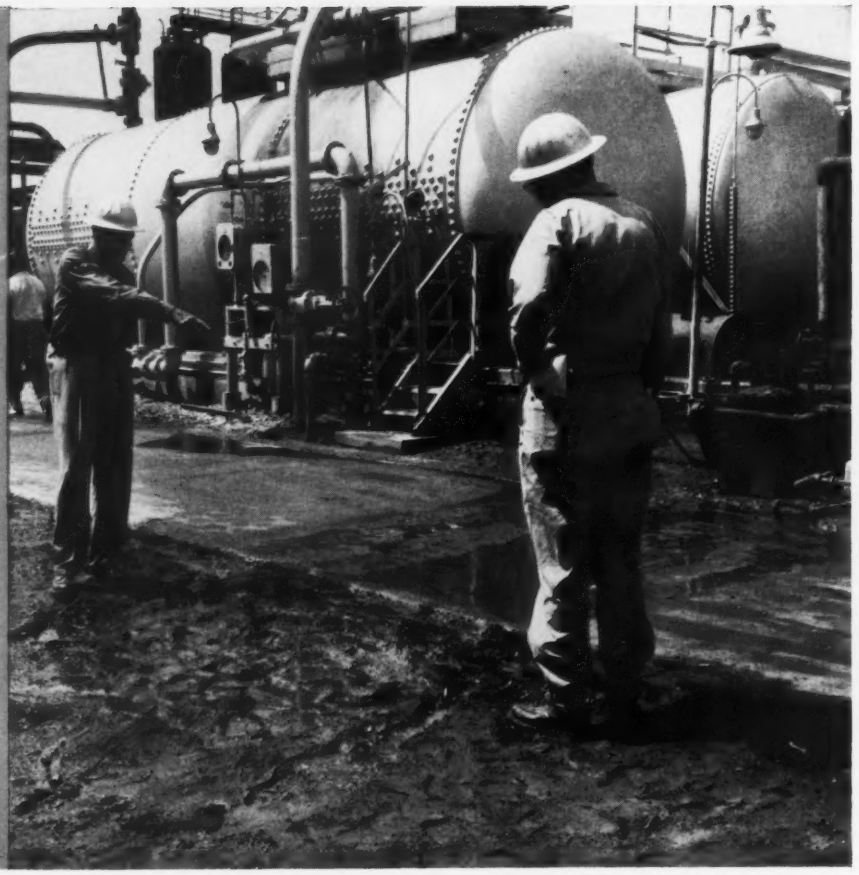
A contributing factor to the success of these openings has been the rivalry

between the four Divisions of the Sales Department. Opening day gallonage records have been short lived for the most part. The first mark high enough to warrant the title "record" was set in Dallas. Soon thereafter it was broken at a Houston opening. After a few months a new Kerrville station wrested the crown from Houston, only to see it drift westward to Odessa in a matter of days. From the far west, laurels soon returned to Houston. They went back to Dallas to remain there for some months, but near the close of 1951 a spectacular opening at Pasadena brought honors back to the Houston Division where they are at this time.

But record or no record, opening day at a new Humble station is a gala event—an event that follows a tested pattern. And all who take part gain satisfaction from knowing that another Humble station has been successfully opened to the motoring public.

Busy salesmen, fluttering banners and balloons bobbing in the breeze all contribute to the exciting impression of activity in this typical opening day scene at a Humble service station. Teamwork and careful planning prevent confusion despite rush.

STOP THAT LEAK!



Baytown Refinery men are finding that a drop of prevention is worth a barrel of cure

At group meetings, refinery men learn how vigilance can prevent oil losses.

THE DRIP, drip, drip of a leaky kitchen faucet may be annoying, but the gallon or so of water it wastes every day is hardly a matter of much concern.

Suppose, however, the leaking valve is in a refinery instead of your kitchen, and oil instead of water is dribbling away at the rate of a gallon a day. In one year almost nine barrels of oil will be lost from that single valve.

And in the refinery there might easily be 2,000 leaking valves instead of one. In twelve months time, the loss from these seemingly insignificant droplets could amount to about 17,000 barrels of oil—worth about $49,000.

Such minor leaks and losses, occurring daily in thousands of places at every refinery, constitute a serious and constant problem. Because of these unaccountable losses, refiners can never come out with quite the quantity of finished products their records indicate they should.

Somewhere among the mazes of pipes, pumps, units and tanks of the refinery, a portion of each day's run of oil disappears as if by magic. Some of it may escape into the air in the form of vapors. Small amounts may be lost in countless drips from pumps, pipes, valves and tanks. Part of the oil may go down the drain with the waste water from some of the refining processes.

In a refinery the size of Humble's Baytown plant, the loss of even a small percentage of the total oil being processed cannot be shrugged off lightly. When 250,000 barrels of crude oil go through the refining processes in a day, a loss of only one-half of one per cent adds up to $3,500.

And there are so many opportunities for losses in a large refinery. With 800

storage tanks, capable of holding 21 million barrels of oil at one time, Baytown's vapor losses alone could easily run into hundreds of barrels a day. And with 2,000 pumps moving oil through 500 miles of pipes, there are innumerable chances for leaks to develop at any time.

Leaks Are Dangerous

Not only are such refinery losses costly, they also constitute a constant safety hazard. Refinery men are well aware that oil vapors are highly inflammable. They know, too, how easily a man can slip and injure himself on an oil-slicked walkway.

Customary precautions have always been taken at Baytown Refinery to prevent oil losses. But for the past few years special emphasis has been given to a loss abatement program in which every refinery employee is encouraged to help prevent leaks.

So successful has this program been that refinery losses have been reduced from an estimated 1869 barrels a day in the third quarter of 1948 to an estimated 781 barrels a day for the same period of 1951. That's a saving of about $3,326 a day.

The loss abatement program is based on studies of the refinery losses over a period of years. A special committee, with members representing all divisions of the refinery, directs the preventive work and sponsors an extensive training program among refinery employees.

One member of the committee is a full-time loss coordinator. With two assistants, he makes constant checks, tests and inspections to see that losses are kept to a minimum throughout the refinery.

In the basic studies of Baytown's oil losses, it became apparent that some phases of the refinery's operations were in need of improvement. A major source of losses was found to be in the evaporation of oil from the open-type oil-water separators. Now more efficient separators have been installed, and are saving some 100,000 barrels of oil a year.

By installing caustic and heat treatment methods, it has been possible to recover annually about 10,000 barrels of oil formerly lost in emulsions.

Considerable quantities of oil were being lost in the treatment of spent catalysts from the two big "cat crackers." By a new method of steam distillation, approximately 11,000 barrels of oil are now being recovered annually from this source.

Even the simple procedure of installing mechanical seals on light hydrocarbon pumps is saving about 60,000 barrels of light oil a year.

When oil is stored in a covered tank, the space between the surface and the top of the tank is filled by vapors. To prevent these vapors from building up too much pressure, vents must be provided in the top. As the tank warms up under the heat of sunlight, the oil vapors expand and are forced out through the vents. And when the tank cools at night, fresh air is sucked in through the vents, causing more vaporization the next day. This continuous process, called *breathing* by refinery men, can waste large quantities of oil unless it is controlled.

Pumping Losses

Alternately emptying and filling a tank with oil creates a similar loss problem. The "empty" space in a tank is actually full of vapors. When oil is pumped into the tank these vapors are forced to escape through the vents. This is known as *pumping* loss.

To prevent breathing and pumping losses, many of the storage tanks at Baytown have now been tied into a vapor recovery system which captures the escaping vapors and reconverts them into liquid oil. Pipes connected to the vent holes of the tanks carry the vapors into a central compression chamber, where they are condensed into liquid form. This light oil can then be stored under pressure.

On other tanks not tied into the vapor recovery system, breathing losses are being reduced by simply painting the tops of the tanks white. White paint reflects much of the sun's heat,

Frequent sampling of waste water being discharged to sewers helps prevent loss of oil and contamination of public waters.

Recovering oil lost by leakage, refinery men use suction hose and portable tank. Oil will be run through reprocessing unit.

Painted signs remind refinery employees to guard against leaks. At main separator, below, waste oil is skimmed from water while another blade scrapes sediment off bottom.

thereby reducing the rate of vaporization of the oil in the tank.

Corrosion of tank bottoms and buried lines—cause of many leaks—has been substantially reduced at Baytown by a method known as *cathodic protection*. It is based on the knowledge that when steel pipes or tanks are set into the ground, an electrical action begins. Electrical impulses go from ground to metal in some spots and from metal to ground in others. Wherever the electricity flow is from metal to ground, minute particles of iron go with it. That is corrosion.

The principle of cathodic protection is to control the direction of the electricity so that none flows from metal to ground. Too technical for simple explanation, the method is nonetheless highly effective. In one area of the refinery, cathodic protection has reduced line leaks ninety per cent.

Considerable quantities of oil used to be lost in the routine drawing off of the water that collects in the bottoms of tanks and units containing oil. These losses have been minimized by use of automatic valves which drain off the water, but close tight as soon as the oil level approaches the valve.

When you pour a quart of oil from a can, a small amount clings to the inside surfaces and remains in the can. The same thing is true, on a larger scale, when the container is a 55-gallon drum, a tank car, or a tanker. Under Baytown's loss abatement program even these relatively small amounts of waste oil are salvaged in the cleaning processes.

Despite all precautions, some oil is bound to escape from a refinery. Such lost oil usually floats on runoff water until it reaches a low spot in the terrain. In the dock area at Baytown a sump pit has been provided in which this runaway oil collects. A tank truck equipped with a suction hose retrieves the oil from the sump from time to time and transfers it to a storage tank for reprocessing.

Those are but a few of the many means by which refinery losses are being combatted at Baytown. Considerable progress has been made in the past few years, but in this war against waste there can be no relaxing of vigilance.

Oil is never a willing prisoner of man, and in the labyrinth of a modern refinery it can find more ways to escape than Houdini at his best.

MOVING OIL BY MICROWAVE

Lofty microwave tower at Warda pumping station is one of the slender steel landmarks along new radio relay system. Topped by metal reflectors, this tower soars 280 feet high to give microwaves line-of-sight path to next relay points.

Humble's new 400-mile microwave radio link will help its Kemper-to-Satsuma pipeline lick weather problem

LIKE most oil companies, Humble has long used radio to get production reports from isolated spots. Now radio is to help it move oil from field to refinery.

Humble Pipe Line Company has installed a 400-mile microwave radio relay system between its Kemper station, near Big Lake in West Texas, and its Houston office.

When it goes on the air in March, this radio "network" (two terminals and 17 repeater stations) will give the company a virtually weatherproof link to all pumping stations on its new Kemper-to-Satsuma pipeline. It will also supplement Humble's existing wire facilities to West Texas.

A 400-mile radio chain may not loom very large when compared with the 11,000 miles of company-owned wire lines, but the new system is expected to relieve at least one serious industrial headache—the weather.

Rough weather—either high winds or pole-snapping ice storms—can play hob with wire communications. Several times in the past, howling blizzards have seriously damaged wire lines in West Texas, leaving a huge area completely cut off from normal communication with the outside world.

For a pipeline, this may mean a costly shutdown. When you handle 55 different grades of crude, as Humble Pipe Line does, with perhaps five or six kinds flowing through a line one behind the other, your timetable must be exactly on the button if the right oil is to wind up in the right tank. You also need to know about leaks or breakdowns in the shortest possible time.

A pipeline, in short, is similar to a railroad. Either is badly crippled without a communications system with (1) speed and (2) continuity of service. Trouble may lurk around any bend of pipe (or rail) and get out of hand in a hurry.

On several wintry occasions, Humble has licked the weather problem only through the dot-dash aid of amateur radio operators. These "hams," although unable to take pay for their services, set up makeshift networks to handle operating orders until ice-felled wire lines could be repaired.

Microwave equipment at Kemper station will provide this West Texas terminal a new telephonic link to home office.

All that has been changed. No longer will bad weather be a disrupting influence on Humble's party line. For the company's new microwave system seems destined to cause the weather problem—ice and all—to melt away.

Microwave radio is a marvel of electronics that makes the walkie-talkie on Dick Tracy's wrist look like a crystal set. If any comic strip fan disagrees, let him take a look at what this newcomer to the airlanes can do:

Microwave radio acts very much like light and hence will travel for only line-of-sight distances, usually no more than 50 miles. It focuses its waves into a narrow beam instead of broadcasting them in all directions. This invisible beam flies with rifle-shot accuracy to a repeater station, where it is boosted to its original strength and then sent winging to a new relay point. On this one narrow beam can ride the equivalent of dozens of radio programs—all at the same time. And microwave does all this with a power of one watt—barely enough to light a photographer's flash bulb!

Another curious facet of microwave's personality is that it actually thrives on bad weather. When arctic gales and sleety downpours are giving wire lines a fit, conditions are usually excellent for microwave transmission.

Microwave also has other advantages. It is much cheaper to install than wire lines, costing as little as $600 a mile as compared with a minimum of about $800 a mile for pole lines and wire circuits. There is practically no static or fading. Using no cross-country wires, it saves on scarce materials such as copper, tin and lead. And its cost of upkeep is comparatively low.

Microwave was first harnessed for man's use a little more than 20 years ago. A group of scientists took the wraps off in 1931 when they met on the Cliffs of Dover to demonstrate the beaming of a message across the English Channel to Calais. At first this new kind of radio made little commercial headway. It was, however, a forerunner of radar, an electronic watchdog which scanned the skies with waves only slightly less high in frequency than those of today's microwave systems.

It was after the war that the new system began to grow by leaps and bounds. It became especially popular with utilities and pipelines. Today, according to a recent *Business Week* report, American industries have installed more than 15,000 miles of microwave relay systems. And that figure is only a starter. Some microwave enthusiasts are forecasting an almost complete disappearance of wire lines.

While there is no primer-simple explanation of microwave, the first thing you should know is that it works in the

Engineer inspects transmitter set-up in penthouse of Houston office building. Dish-shaped object at right is antenna.

super high frequencies. Most handymen are familiar with low frequency currents such as the 60 cycles used in household currents. This means the electric current reverses itself 60 times a second. In standard radio broadcasting, the frequency range runs as high as 1500 kilocycles, or a million and a half cycles a second. Microwave frequencies, however, are in the range of 7000 megacycles—or *seven billion cycles a second!*

Radio frequencies this high act quite different from those which bring you Amos 'n' Andy each Sunday. These latter waves bend considerably, and an ionized layer in the atmosphere reflects them back to earth great distances away from the broadcasting station.

Microwaves, on the other hand, show many of the characteristics of light. They go out in a straight line, and there must be a line-of-sight path between transmitter and receiver. For that reason, every effort is made to locate towers of repeater stations at the highest spots along the route. In general, fewer relay stations are needed in rugged terrain than in so-called flatland country.

A parabolic reflector similar to that in an automobile headlight is used as an antenna. This focuses the microwaves into a narrow beam with an angle of about three degrees. Since this focusing process is a great conserver of power, about 100 million times as much energy reaches the microwave receiver as it would if the waves were broadcast. That's why a microwave station can transmit with power of one watt or less.

In Humble's system, the parabolic reflector is placed near the ground in an equipment house at the base of the tower. The microwave beam flows from this parabaloid to the top of the tower where it strikes a large rectangular "passive reflector" made of steel. This passive reflector is tilted at an angle of approximately 45 degrees, and the beam banks off to a horizontal plane and travels to the next tower. Here it hits a similar reflector which deflects it downward into the receiving parabaloid.

The process continues until the beam reaches its destination. Each repeater station receives the weakened signal, amplifies it to its original strength, and then sends it out at normal volume.

The microwave channel is broad enough to accommodate many simultaneous telephone conversations. Humble will use only eight channels at the outset, but its system is expansible to 24 telephone channels. Any of these is capable of providing 12 circuits for teletype machines and several more circuits for services such as telemetering and other remote operations.

Humble Pipe Line stations to have service from the system are Kemper, Fort McKavett, Eckert, Warda, Katy Cycling Plant, and Satsuma. Each station will have two "dropout" circuits, one for telephone service, the other for telemetering and supervisory control. Each station can talk to any other along the route, and all can talk to the Houston office.

Standby power has been provided at each terminal and repeater station. If the power line serving a station conks out, a small gasoline-engine-driven generator will start automatically and take over the load. Once repairs have been made, the generator will shut itself down and shift the load back to the power line.

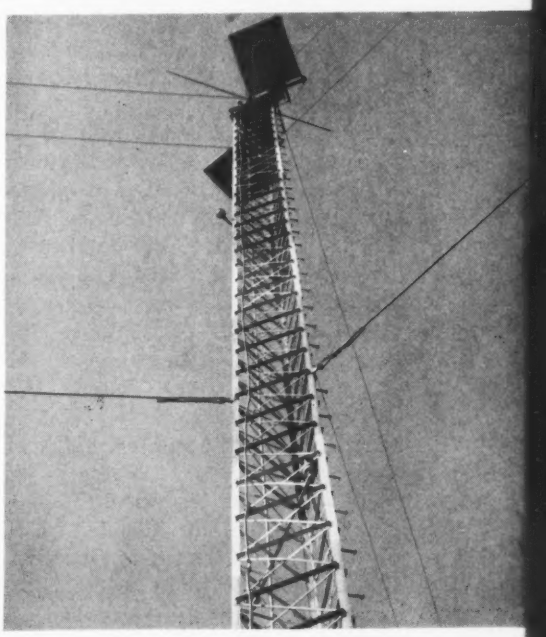
The 18 microwave towers (Humble's Houston office building serves as the 19th) range in height from 80 feet to 280 feet. These slender steel pylons stand out javelin-thin against the horizon, and most are tall enough to require airplane warning lights. Selenium cells, sometimes called electric eyes or sun switches, turn the warning lights on and off.

Electronic equipment as efficient as burglar alarms will enable the wire chief in Houston to detect trouble anywhere along the microwave route. By making certain tests, he can tell if the warning lights are burning, whether the emergency generator is running, and whether there is an equipment failure at any of the repeater stations. If trouble pops up, a technician can immediately be dispatched to make repairs.

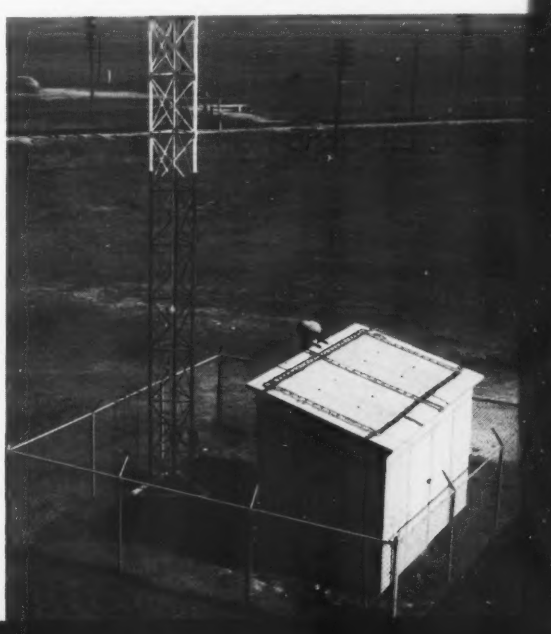
How dependable will the new system be? Well, one eastern pipeline reported last year that its microwave communications were in operation 99.22 per cent of the time—this in spite of some very adverse weather.

Now undergoing final tests, Humble's new system should be in full operation by March 1. The company will then start "moving oil by microwave," and none of the traditional obstacles—neither snow, nor rain, nor gloom of night—will be the threat they once were.

Kemper differs from other stations in that parabaloid antenna is atop steel tower.



Passive reflectors crown all other towers while antenna is in house like one below.



Twenty-Three Employees Retire

All but two of recent annuitants have more than 21 years of service; eight have 30 years or more

TWENTY-THREE long-time employees have retired since these columns last reported, all except two of them with more than 21 years' service. Eight have 30 years' or more service with the Company. The employee with the longest period among the group is William G. Lopas, Sr., senior payroll clerk in the Treasury Department, who is credited with 33 years.

Humble Pipe Line Company—Guy T. Blackwell, pipeliner at Pierce Junction, retired December 19 after more than 16 years' service. Mr. Blackwell first joined Humble in July, 1927, at Luling but later resigned. In 1934 he returned to the Company at Baytown as a painter. He has worked in various capacities for the Company at Pendell, Hempstead, Comyn, Hearne, Longview, Pierce Junction, Thompson, Friendswood, and Tomball.

Robert C. Callan, engineer at Pipe Line Station B, retired January 12 after more than 24 years' service. Mr. Callan started to work for Humble as a laborer. With the exception of about seven months, he has spent his entire service at Station B. Fishing and hunting are his hobbies. He is now building a house in Junction, Texas, where he plans to make his home.

Charles B. Tankersley, oiler at Pendell Station, retired January 26 after almost 21 years' service. He was employed at Groesbeck as a laborer and later worked as fireman, oiler, stock gauger, engineer, and pipeliner. His interests include fishing, hunting, gardening, and church activity. He plans to build a home in Valley Mills, Texas, where he will move his family. He has two sons, ages 15 and 17.

Elmer Trantham, line rider at Cisco District, retired January 29 after more than 30 years' service. He started with Humble as a laborer and later worked as stock gauger, roustabout, and line rider or walker. More than 26 years of his service has been spent in this last capacity. He expects to go into the cross-tie mill business with his brother.

Production Department—John L. Foster, Sr., lease pumper-gauger at Flour Bluff, retired December 1 after more than 24 years' service. Mr. Foster joined Humble in the Navarro Field. Later, he worked for the Company in Powell Field, Luling, and Flour Bluff districts. His special interests are hunting and fishing. On retirement, he plans to raise chickens. In the future, he intends to buy a small tract of land on which he can build a home.

Robert B. Rodgers, roustabout at Friendswood, retired December 30 after 30 years' service. Employed at West Columbia, he began work as a rotary helper for the Company. He includes hunting, fishing, and other sports among his special interests. He owns eight acres and a house near Alvin, where he plans to raise a garden and chickens during retirement.

Wesley C. Thomas, roustabout at Conroe, retired February 6 after more than 30 years' service. He includes among his hobbies baseball, football, rodeos, and other sports. He owns 64 acres at Tarkington Prairie, where he plans to build a home and raise cattle.

William O. Salter, rotary fireman at Lovall Lake, retired January 16 after more than 22 years' service. He joined Humble as a rotary helper at Raccoon Bend and later worked as janitor, engineman, roustabout, driller, and rotary fireman. Hunting and fishing are his hobbies.

Baytown Refinery—Fay Bryant, assistant bookkeeper, retired December 3 after more than 31 years' service. She began work as a comptometer operator in the Accounting Department of the Refinery, where she served her entire period of employment. She is one of the first women employed at the Refinery and the first woman there to retire with more than 30 years of service. During retirement she plans to write travel stories and take care of her new home, now under construction.

Henry L. Ashley, car inspector, retired February 1 after more than 30 years' service. He started at the Refinery as a laborer and later worked with the machinists, blacksmiths, boilermakers, and car repairmen in various capacities. His interests are raising cattle, hunting and fishing; he plans to buy and sell cattle on retiring.

Ettore J. Bucci, brickmason first, retired February 1 after more than 28 years' service. His service with the Company has been spent as a bricklayer and brickmason. During retirement, he plans to work at his trade occasionally and make a trip to Italy.

John T. Garrett, helper first, retired February 1 after more than 26 years' service. All of his employment with Humble has been at Baytown Refinery. When he retired, he was a member of the Refinery's Distillation Department. He plans to manage a ranch during retirement.

Henry Istre, boiler repairman helper, retired December 12 after more than 16 years' service. All of Mr. Istre's service has been with the Refinery, where he started as a laborer in the Labor Department. He includes hunting and fishing among his special interests.

Ignac F. Kristynek, helper, retired February 1 after more than 31 years' service. He began work at the Refinery in its Pipe Department as a helper. Later, he worked in the Carpenter and Labor Departments, finally returning to the Pipe Department before his retirement. He plans to manage some property in Baytown.

Clarence T. Maris, boilermaker second, retired February 1 after almost 29 years' service. All of his employment with Humble has been in the Refinery's Boilermaker Department. He intends to do some farming of feed crops in retirement.

Cadge Dias, machinist first, retired November 30 after more than 21 years' service. All of his service with the Company had been spent in the Refinery's Machine Department. His special interests include church work, in which he plans to remain active during his retirement.

Monroe Gray, laborer special, retired December 11 after more than 25 years' service. He began work with the Company in the Refinery's Labor Department and later transferred to the Compound and Package Department, where he worked until retirement. His entire employment was at the Refinery. His special hobbies include hunting and fishing. During retirement he will move to Onalaska, Texas, in Polk County, where he will do some truck farming on 80 acres that he owns.

James E. Green, separator helper, retired January 5 after more than 24 years' service. He started to work in the Boilermaker Department as a helper. His entire service was spent at the Refinery. Traveling is considered one of his main interests. He will remain in Baytown awhile following his retirement and then move to his former home in Ben Wheeler, Texas.

Frank S. Tomlinson, helper first, retired January 3 after almost 24 years' service. Mr. Tomlinson joined Humble in the labor gang at McCamey Refinery. Later he transferred to the Neches Refinery. In January, 1943, he started to work at Baytown Refinery as a helper first in the Reclamation Department. He includes fishing and hunting among his hobbies. He plans to move to Grant's Pass, Oregon, where he owns a small ranch. There he will garden, raise chickens, and care for a fruit orchard.

Houston Office—Augustus L. Buller, follow-up clerk in the Purchasing Department, retired February 2 after more than 32 years' service with the Company. All of his employment has been spent in the Houston Office.

James I. Houston, chief rate clerk in the Traffic Bureau, retired December 27 after almost 23 years' service. His entire service has been in the Traffic Bureau. Before joining Humble, he worked for the Southern Pacific Lines.

Winfield C. Landry, shop foreman in Production Research, retired January 8 after more than 21 years' service. He joined Humble as a machinist in the Geophysics Shops. All of his employment was in the Houston Office. He built the first Humble subsurface pressure gauge. Also, he supervised the construction of the first Humble subsurface sampler and the first laboratory apparatus used by the Company to examine subsurface oil samples. Louisiana cooking, hunting, and fishing are among his special interests. During retirement, he plans to work at inventing and developing mechanical equipment.

William G. Lopas, Sr., senior payroll clerk in the Treasury Department, retired January 31 after 33 years' service. He joined Humble in the Refining Department while it was still in the old Gulf Building. When construction got under way at Baytown Refinery in 1919, he went there as cashier and pay master. In early 1929 he returned to the Houston Office as traveling payroll auditor for the Refining Department. In April, 1932, he returned to the Treasury Department.

Deaths

Since the last issue of THE HUMBLE WAY, eight active employees and one annuitant have died.

Active employees who have died are: Kenneth C. Bradberry, 46, boilermaker first at Baytown Refinery, on December 14; Harold W. Browning, 26, pipeliner at Odessa, on December 15; Leroy B. Gunn, 50, electrician, air conditioning and maintenance man, at the Houston Office, on November 30; Irwin F. Pettey, 64, district superintendent at Mexia District on December 4; Arthur L. Poteet, 48, valve repairman at Baytown Refinery, on January 20; Edmond H. Shultz, 61, lease pumper-gauger at Raccoon Bend, on December 5; John H. Thomson, 56, terminal foreman at the Houston Fuel Oil Terminal, on February 2; William W. Wolters, 60, working shop foreman at Baytown Refinery, on January 10.

Annuitant: William R. McLees, 64, clerk at Baytown Refinery before his retirement, died on December 27.

Employees Recently Called to Military Service

AIR FORCE	
Beyer, Alvine L.	Clear Lake Gas Plant
Bramlett, Billie Jean	Baytown Refinery
Campbell, Donald Gene	Odessa Production
Elkin, James Lawrence, Jr.	Exploration-Geophysics, Texas
Evans, Bert Edwin, Jr.	Sales Accounting, Houston
Everitt, Homer Ernest	Crude Oil Accounting, Houston
Faires, Allen Leroy	Exploration-Geologic Research, Houston
Gaugler, Frederick Jackson	Crude Oil Division Order, Houston
Hudson, S. R.	Exploration-Geologic Research, Houston
Kasper, John F., Jr.	Government Wells Production
Lannou, Y. M.	Baytown Refinery
McAdams, Arley Ray	Avery Island Production
McBride, Bill	Baytown Refinery
Milner, James Maxwell	Sales-Advertising, Houston
Moorman, Elmer Ray, Jr.	Baytown Refinery
Morris, Gordon Ferrel	Crude Oil Accounting, Houston
Rowland, Melvin C.	Production Operating, Houston
Waight, Earl Avant	Baytown Refinery
ARMY	
Boquet, Percy Victor	Eucutta Production
Griffin, James Presley	Bayou Sale Production
Hand, Brady Arnold	Stationery, Printing, Houston
Jones, Jacob Paul	Mallalieu Production
Patterson, Carl Richard	Exploration-Geologic, Texas
Simoneaux, Mervin Joseph	Potash Production
Weisinger, Felix Mack	Land Records & Rentals, Houston
MARINES	
Black, John Alber	Friendswood Production
Brown, Sammie Lee	Stratton Production
NAVY	
Adams, James Wesley	Exploration-Geophysics, Texas
Barber, Philip E., Jr.	East Texas Division Office, Tyler
Cole, Frank W.	Petroleum Engineering, Houston
Cooper, Marlyn Lee	Production Operating, Houston
Dotson, Myra Julia	Baytown Refinery
Dougherty, Richard Gayle	East Texas Division Office, Tyler
Gajewski, John Philip	Stationery, Printing, Houston
Horton, Melvin Leo	Exploration-Geologic
Johnson, George Henry	Baytown Refinery
McEachern, Charles Edward	Gulf Coast Division Office, Houston
McGonigle, Joseph Robert	West Texas Div., Office, Sales, Abilene
Sowell, George Curtis	Baytown Refinery
Spruance, Owen E., Jr.	Sales Technical Service, Houston
Walker, Robert James, Jr.	Exploration-Geologic, Houston

By the way . . .

JOHN Q. WEATHERLY

HERMAN P. PRESSLER

John Q. Weatherly and Herman P. Pressler Are Named Associate General Counsels

JOHN Q. WEATHERLY and Herman P. Pressler have been appointed associate general counsels of Humble Oil & Refining Company and assistants to Rex G. Baker, general counsel for the Company.

The step was taken, said President Hines H. Baker, because of the great volume and complexity of legal problems of the Company, and to increase efficiency in handling the work of the Law Department. Mr. Weatherly and Mr. Pressler will have extensive supervisory duties in their new positions.

Mr. Weatherly was born in Walker County, Texas. He attended Sam Houston State Teachers' College, Baylor University Law School, and the University of Texas Law School. He practiced law in Houston for several years, and then joined Humble's Law Department in 1926.

Mr. Pressler was born in Austin and educated at Virginia Military Institute and the University of Texas Law School, from which he received his LL.B. degree in 1925. Before joining the Company in 1933, he also practiced law in Houston.

He is a director of Humble Pipe Line Company and a past president of the Houston Bar Association. He has served twice as chairman of the mineral section of the State Bar of Texas.

New West Texas Division Office Building In Midland Will Open March 6-7

HUMBLE'S new four-story office building for the West Texas Division headquarters at Midland will be opened March 6 and 7. The new building, which adds to Midland's rapidly growing, oil-built skyline, has a foundation design which allows for the addition of three more stories. It will house 190 division personnel from the Exploration Department, the Production Department, and the Humble Pipe Line Company.

Built of steel-reinforced concrete with a masonry exterior, the new office building contains more than 40,000 square feet of floor space. The site of the building, with parking space for 120 cars, covers about half a block.

The HUMBLE WAY

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Published every other month for employees and stockholders

HUMBLE OIL & REFINING COMPANY

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Creating a carnival spirit, gaily colored balloons and banners are put up, to give notice that another new Humble station will be open for business the next morning. (See page 17.)

ESSO
EXTRA
MOTOR OIL
GASOLINE
BEST
ESSO
EXTRA
MOTOR OIL
GASOLINE
BEST
YOU CAN
BUY!

that
17.)

We're Neighbors

Wherever you live in Texas, the oil industry is your neighbor.

For the Texas oil industry is the bread-and-butter, the opportunity, the daily work of some 190,000 Texas men and women.

The girl who sits next to you in the bus; the hearty-looking man who waves as you pass on the highway; the family behind you at the PTA; in Texas, they all could be, some certainly are oil workers. Bookkeepers, stenographers, executives, drillers, roughnecks, stillmen, geologists, salesmen, pipe liners, petroleum engineers—the oil industry supplies the livelihood of all, and many more.

Neighbors of yours, these people are, folks who pay taxes like yours, spend their money in the stores you patronize, drive the same kind of automobile, send their children to the same schools.

. . . The oil industry is more than a balance sheet, a set of statistics, an investment in derricks and pipestills. In Texas, *it's the family next door.*

HUMBLE OIL & REFINING CO.
HUMBLE PIPE LINE CO.

(This advertisement is one of a series which has been appearing in Texas newspapers and magazines. Similar advertisements were also published in other states in which Humble carries on operations.)